



Supplemental Guidance for Using DEQ's Sampling and Analysis Plan (SAP) Template for Volunteer Water Quality Monitoring Programs

K. Makarowski
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What are Sampling and Analysis Plans (SAPs) and why are they important?

A Sampling and Analysis Plan (SAP) is a document which describes the objectives and procedural and analytical requirements of monitoring projects. SAPs communicate key aspects of monitoring project plans to project partners, funders, analytical laboratories, and volunteers collecting the data. A SAP should describe the overall goal of the sampling project, the specific project objectives, the number and type of data to be collected, the quality control measures that will be taken to ensure data is sufficiently high quality, and an overview of how data will be stored and analyzed to achieve the specific monitoring objectives. A SAP should contain all critical information necessary to ensure project continuity in the case that project managers or field crews change over time. A SAP should contain sufficient detail so it can serve as a step-by-step planning and sampling guide for project managers and volunteers.

How to use the SAP Template

DEQ created a template to help guide volunteer water quality monitoring programs who are developing SAPs. Users of this template should maintain each section heading in their SAP. The template includes instructions, example language, and the tables and figures which should, at a minimum, be included in each section. Some example language, such as that found in the quality assurance and quality control section, may be appropriate to include verbatim. However, users of this template should carefully review all language and modify it as needed to reflect project-specific details.

This Supplemental Guidance document also provides a brief overview of data requirements associated with several of DEQ's water quality assessment methods. This guidance helps volunteer monitoring programs understand the type and quality of data required by DEQ staff when evaluating attainment of water quality standards and identifying impaired waters. This is guidance and not required. Please contact DEQ staff for clarification on these methods.

Template Key

Black	Section headings, table titles and language that can generally be left unmodified; users of this template should review all language to ensure it is relevant to their
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	project.
Red	Description of the purpose of each section of the document. Delete this red language once section is complete.
Blue	Suggestions or guidance for the types of information (narratives, tables and figures) that should be written by the template user and included in each section. Examples are provided. Delete this blue language once the section is complete.
Gray Highlight	Information that should be filled in by template user.

Tips for writing effective SAPs:

- Include a big-picture project goal which describes why the monitoring project is important and how it will help achieve good water quality – this will help people rally behind the project.
- Include specific and achievable monitoring objectives which can be achieved through collection and analysis of specific parameters – these are often stated as research questions or hypotheses.
- Include a data analysis strategy that describes how each parameter will be evaluated and how this information will achieve the monitoring objectives and project goals.
- For monitoring projects that are ongoing from year to year, consider using a completed SAP from one year as a template for future years – the version can be modified from year to year to reflect changes – this will save time and will create a record of the SAP associated with each year’s data.
- After sampling activities described in the SAP are complete, write a brief addendum to document, for example, any substantial deviations from the SAP, the final sampling locations, and pertinent site access and landownership information.
- Make it useful! No one wants to write a document that no one will read or use – the act of writing a SAP can be helpful toward developing thoughtful, organized, and efficient monitoring plans.

How to Find Waterbody Impairment Status and Assessment Records

- View an assessment record for a waterbody (if one exists):
 - visit Montana DEQ’s Clean Water Act Information Center (CWAIC) at <http://deq.mt.gov/Water/WQPB/cwaic>
 - click “Search” icon
 - Search by waterbody name, assessment unit ID (AUID), location, category, impairment, etc.
 - Click on relevant assessment unit ID (AUID) to view overview of water information, beneficial use support status and impairment information.
 - Click on “View Data in Map” to see monitoring locations, water quality data results and other information (your selected stream will appear highlighted in yellow)
 - Click on “Detailed Assessment Report” to view the waterbody’s assessment record. Note that the information contained in this assessment record is the most current assessment that has been completed. However, waterbodies are not reassessed every year so assessment record and impairment information carries over from year to year until reassessment occurs; the year shown on the first page is that of the most recent assessment.

Montana DEQ Nutrient Assessment Method – Data Quality Overview

- DEQ's assessment method for nutrients in Wadeable streams ("Assessment Methodology for Determining Wadeable Stream Impairment Due to Excess Nitrogen and Phosphorus Levels") (Suplee and Sada de Suplee, 2011) can be found at <http://deq.mt.gov/Water/WQPB/qaprogram/sops>
- Montana's numeric water quality standards for total nitrogen and total phosphorus can be found in DEQ's Department Circular DEQ-12A ("Montana Base Numeric Nutrient Standards") (DEQ, 2014) at https://deq.mt.gov/Portals/112/Water/WQPB/Standards/NutrientWorkGroup/PDFs/NutrientRules/CircularDEQ12A_July2014_FINAL.pdf
- Several aspects of DEQ's nutrient assessment method varies by ecoregion (i.e., mountainous & transitional ecoregions common in western MT or prairie ecoregions common in Eastern MT), including the applicable numeric criteria, supplemental data types, and decision rules.
- Key data requirements:
 - **Minimum sample size:**
 - at least 13 if stream is currently listed as impaired for nutrients
 - at least 12 if stream is currently not listed as impaired for nutrients
 - **Sample Timeframe:**
 - Samples are collected only during the summertime growing season when nutrient criteria apply, which varies by ecoregion:

Ecoregion	Period when criteria apply
Northern Rockies	July 1 - September 30
Canadian Rockies	July 1 - September 30
Idaho Batholith	July 1 - September 30
Middle Rockies	July 1 - September 30
Northwestern Glaciated Plains and Wyoming Basin	June 16 - September 30
Transitional: Non-calcareous Foothill Grassland (43s), Shields Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o)	July 1 - September 30

- **Spatial independence:**
 - Sites should be located at least 1 stream mile apart. Sites may be placed < 1 mile apart on an assessment reach **if** there is a flowing tributary confluencing with the reach or a discrete point source between the two sites.
 - Sample sites on a waterbody beginning downstream and moving upstream to avoid inadvertently re-sampling water.
 - Consider land use and land form changes to help determine sampling reach breaks and when selecting representative sites along a waterbody.
- **Temporal Independence:**
 - Samples collected at the same site should be collected at least 14 days apart
- **Typical Nutrient Monitoring Suite:**

Parameter	Preferred Method	Alternate Method	Required Reporting Limit ug/L	Holding Time Days	Bottle	Preservative
Water Sample - Common Ions, Physical Parameters, Miscellaneous						
Total Suspended Solids (TSS)	A2540 D		4000	7	1000 ml HDPE	≤6°C
Water Sample - Nutrients						
Total Persulfate Nitrogen (TPN)	A4500-N C	A4500-N B	40	28	250ml HDPE	≤6°C (28d HT), Freeze (45d HT)
Total Phosphorus as P	EPA 365.1	A4500-P F	3	28	250 ml HDPE	H ₂ SO ₄ , ≤6°C or Freeze
Nitrate-Nitrite as N	EPA 353.2	A4500-NO ₃ F	10			

- **Additional Parameters** (these are more complex to collect and costly to analyze; consult with DEQ staff if you are considering monitoring for these parameters)
 - Benthic algae (chlorophyll-a and ash-free dry mass)
 - Diatoms (periphyton)
 - Macroinvertebrates (mountainous streams only)
 - Daily Maximum minus daily minimum dissolved oxygen (plains stream only)

Montana DEQ Metals Assessment Method – Data Quality Overview

- DEQ's Metals Assessment Method (Drygas, 2012) for all surface waters can be found at <http://deq.mt.gov/Water/WQPB/qaprogram/sops>
- DEQ's numeric water quality standards for metals can be found in DEQ's Department Circular DEQ-7 ("Montana Numeric Water Quality Standards") (DEQ, 2017) at http://deq.mt.gov/Portals/112/Water/WQPB/Standards/PDF/DEQ7/DEQ-7_Final_May2017.pdf
- **Minimum sample size:**
 - A minimum of 8 independent samples should be collected
- **Sample Timeframe**
 - Samples can be collected year-round
 - At least 33% of the samples should be collected during high flow conditions (e.g., runoff periods when metals are especially likely to be mobilized)
 - Consider data from the last 10 years; consider whether conditions have changed since data was collected.
- **Spatial Independence:**
 - Sampling sites should be at least one mile apart. Sites may be closer than one mile if a flowing tributary confluences or if a discrete metals source (e.g., tailings piles, discharging mine adit, abandoned or active mine) is located between the two sites.

- **Temporal Independence:**

- During baseflow conditions, samples collected at the same site should be collected at least 7 days apart.
- During high flow conditions, temporal independence is evaluated on a case-by-case basis to determine if samples collected within 7 days can be considered independent.

- **Basic Metals Monitoring Suite:**

- All metals analyses are total recoverable except aluminum which is the dissolved fraction.
- Mercury monitoring requires an “ultra-low level” method which differs from the method used to collect other metals and involves additional training and supplies. Mercury monitoring is only recommended when mercury concentrations of concern are likely.
- Hardness is required as several numeric metals standards are hardness-dependent.

Parameter	Preferred Method	Alternate Method	Required Reporting Limit ug/L	Holding Time Days	Bottle	Preservative
Water Sample - Common Ions, Physical Parameters, Miscellaneous						
Total Suspended Solids (TSS)	A2540 D		4000	7	1000 ml HDPE/ 500 ml HDPE	≤6°C
Water Sample - Dissolved Metals (0.45 um filtered)						
Aluminum	EPA 200.7	EPA 200.8	9	180	250 ml HDPE	Filt 0.45 um, HNO ₃
Water Sample - Total Recoverable Metals (unfiltered)						
<i>Total Recoverable Metals Digestion</i>	EPA 200.2	APHA3030F (b)	N/A	180	500 ml HDPE/ 250 ml HDPE	HNO ₃
Arsenic	EPA 200.8		1			
Cadmium	EPA 200.8		0.03			
Calcium	EPA 200.7		1000			
Chromium	EPA 200.8	EPA 200.7	1			
Copper	EPA 200.8	EPA 200.7	1			
Iron	EPA 200.7		20			
Lead	EPA 200.8		0.3			
Magnesium	EPA 200.7		1000			
Potassium	EPA 200.7		1000			
Selenium	EPA 200.8		1			
Silver	EPA 200.8	EPA 200.7/200.9	0.2			
Sodium	EPA 200.7		1000			
Zinc	EPA 200.7	EPA 200.8	8			

Parameter	Preferred Method	Alternate Method	Required Reporting Limit ug/L	Holding Time Days	Bottle	Preservative
Water Sample - Total						
Mercury, Ultra low level	EPA 245.7		0.005	28	100mL Glass	0.5 ml 12N HCl
Water Sample - Calculated Results						
Total Hardness as CaCO ₃	A2340 B (Calc)		1000			

- **Additional Parameters**

- Metals assessment decisions are based on metals concentrations in the water column only and do not directly apply concentrations of metals in benthic sediments. Sediment metals data can be useful in understanding sources and risk of metals entrainment.
- Collect sediment metals samples during baseflow conditions.
- Consider collecting sediment metals in depositional areas and downstream from known or suspected metals source areas.
- NOAA's Screening Quick Reference Tables (SQiRT) (i.e., Table for Inorganics in Sediment) can be used to evaluate sediment metals data (Buchman, 2008).
- Basic suite for sediment metals:

Parameter	Preferred Method	Alternate Method	Req. Report Limit mg/kg (dry weight)	Holding Time Days	Bottle	Preservative
Sediment Sample - Total Recoverable Metals						
Total Recoverable Metals Digestion	EPA 200.2		N/A	180	2000 ml HDPE Widemouth	None
Arsenic	EPA 200.8	EPA 200.9	1			
Cadmium	EPA 200.8	EPA 200.9	0.2			
Chromium	EPA 200.8	EPA 200.7	9			
Copper	EPA 200.8	EPA 200.7	15			
Iron	EPA 200.7	EPA 200.7	10			
Lead	EPA 200.8	EPA 200.9	5			
Zinc	EPA 200.7	EPA 200.7	20			
Sediment Sample - Total Metals						
Mercury	EPA 7471B		0.05	28	2000 ml HDPE Widemouth	None

Montana DEQ's Field Procedures Overview

- If you are following DEQ's sampling methods, this language can be modified as needed in your sampling methods section of your SAP. Most language is modeled after method descriptions found in DEQ's Field Procedures Manual (DEQ, 2012) available at <http://deq.mt.gov/Water/WQPB/qaprogram/sops>.
- If you need sampling method guidance, contact DEQ's volunteer monitoring program coordinator for additional information.

***In Situ* Chemistry Measurements**

During each sampling event at each sampling site, a [YSI 85 field meter](#) will be used to collect *in situ* measurements of water temperature, dissolved oxygen, and specific conductance, and a [portable pH meter](#) will be used to measure pH. Air temperature will be recorded from a thermometer. These measurements will be collected prior to the collection of water samples or other physical disturbances to the water column or substrate.

Unfiltered grab samples

(TN, TP, NO₂₊₃, NH₃₊₄, TSS/TDS, total recoverable metals)

For each sample, the bottle and lid will be triple-rinsed with a small amount of ambient stream water prior to grabbing the final sample. TN will be collected in a single 250ml HDPE bottle and kept on ice (not frozen) until analyzed. TP and NO₂₊₃ will be collected in a single 250ml HDPE bottle, will be preserved with sulfuric acid and kept on ice (not frozen) until analyzed. TSS/TDS will be collected in a single 1000 ml HDPE bottle and kept on ice (not frozen) until analyzed. Total recoverable metals will be collected in a single 250ml HDPE bottle, will be preserved with nitric acid and kept on ice (not frozen) until analyzed. Hardness will be calculated from the total recoverable metals bottle.

E. coli

Detailed methodology for sample collection and analysis can be found in the *E. coli* Standard Operating Procedure (DEQ, 2006). All *E. coli* water samples will be placed in new 100 ml high-density polyethylene (HDPE) bottles supplied by the laboratory. Bottles will be pre-treated with sodium thiosulfate by the laboratory; no additional preservative will be added to the sample bottle during or after sample collection, and no pre-rinsing will occur in the field. Samples will be stored on ice in a cooler at a temperature of <6 degrees Celsius. *E. coli* samples will not be held more than six hours between collection and initiation of analysis (DEQ, 2006). **Note: E. coli has a 6-hour holding time.**

One packet of Colilert will be added to each *E. coli* sample (IDEXX, 2017); the sample will be gently inverted at least three times until the Colilert granules have dissolved. Each sample will be poured into a QuantiTray; each tray will be sealed and labeled with the corresponding site visit code, and cut in half to fit into the incubator. Each sample will be incubated at 35 ± 0.5 degC for 24-28 hours. A blacklight will be used to read the QuantiTray *E. coli* results.

Total Recoverable Mercury

Total recoverable mercury using the ultra-low level method follows a different sample collection procedure from other total recoverable metals samples. Samples will be collected in a 100 ml glass bottle and will be kept on ice (not frozen) until analyzed. Detailed methodology for the "clean

hands/dirty hands” sample collection procedure can be found in DEQ’s Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring (DEQ, 2012).

Filtered grab samples

Dissolved Aluminum

Water will be filtered through a 0.45 µm filter and 50 ml of the filtrate will be placed in a 250 ml HDPE bottle, preserved with nitric acid and kept on ice (not frozen) until analyzed. Filtration will be accomplished with a 60 cm³ syringe connected to a disposal 0.45 µm filter capsule. A small amount of the sample will be wasted through the filter and the sample bottle and lid will be triple-rinsed with a small amount of filtrate before the final filtered sample is collected. Detailed methodology can be found in DEQ’s Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring (2012, available at <http://deq.mt.gov/Water/WQPB/qaprogram/sops>).

Benthic sediment metals samples

Sediment metals will be passed with a minimal amount of ambient stream water through a Teflon 60-micron sieve using a Buchner funnel into a 2000 ml HDPE bottle without preservative and held on ice (not frozen) until analyzed. Detailed methodology can be found in DEQ’s Water Quality Planning Bureau Field Procedures Manual for Water Quality Assessment Monitoring (DEQ, 2012).

Discharge (Flow)

Flow will be measured at each site during each sampling event typically using the quantitative flow meter method; the semi-quantitative float method will be used, as necessary, when high flows prevent wading (DEQ, 2012). Flow will not be measured in the field when a site is situated at or near a USGS gage station.

Routine Digital Site Photographs

Digital photographs will be taken (at a minimum) at each site and during each sampling event, with at least one photo facing upstream, facing downstream and facing across the channel. Additional photos will be taken as deemed necessary by field crews to document changes in riparian vegetation condition, land uses, stream flora, flow conditions, water clarity, etc. Photos will be a combination of close-ups of water and substrate conditions as well as stream panoramas. The photo number and pertinent photo location, notes or other pertinent information will be recorded for each photo.

Long-term Photo-Point Monitoring

Photo-point photographs are an exact replicate of previous photos taken at the same location during multiple site visits to document changes in stream and riparian conditions over time. A *Photo Point Guide* document will be developed and used at each sampling location which includes directions to the site and instructions for locating and repeating photos. First, field crews will navigate to the site and locate the position that the photograph is to be taken from. Second, field crews will identify the features in the photo that let you know you are repeating it exactly. The camera should not be zoomed in unless specifically directed in the Photo Point Guide. The photo number and pertinent photo location, notes or other pertinent information will be recorded for each photo.

Monitoring Objectives Supported by DEQ

For a VM program to receive support through DEQ's VM Support Program, it needs to have one or more clearly defined monitoring objective(s). This section outlines several common monitoring objectives, all of which overlap with DEQ's water program objectives. Provided for each objective is:

1. a brief general description of the objective
2. an overview of the mechanisms DEQ may use to support those efforts, and
3. examples of how DEQ benefit from volunteer involvement with the objective.

Objective 1 – Problem Identification

Monitoring is conducted to collect data that can be used to verify a perceived water quality problem. For example, one may suspect a waterbody is not meeting a particular water quality standard. A VM program may collect relevant water quality parameters to help them make informed decisions in managing the resource, and to decide whether there is sufficient evidence to warrant approaching DEQ about the perceived problem. This data may help that program better communicate the problem to DEQ and others.

DEQ provides lab analysis support to groups that are collecting data to investigate water quality problems. When presented with data backing a concern, DEQ may evaluate if DEQ will commit additional monitoring or other resources to investigating the perceived problem. DEQ may partner with a VM program to collect additional information, possibly providing lab analysis support and convening a panel of professionals to help guide monitoring designs (e.g., forming hypotheses, selecting parameters, selecting field methods, developing data quality objectives, etc.).

DEQ benefits from this objective in several ways. When concerned citizens have quality information to help validate their suspicions of a water quality problem prior to approaching DEQ about the concern, DEQ can make a more informed decision about how to follow up on the issue. This objective can help to identify potential water quality problems in areas where DEQ is not currently actively monitoring, and alert DEQ to the problems that are important to the public. These efforts can also help gather quality datasets relevant to investigations if DEQ follows up on the problem, reducing the need for DEQ monitoring resources.

Objective 2 – Water Quality Standards Attainment (303(d)) Assessments

DEQ routinely assesses whether waterbodies are meeting water quality standards and supporting designated beneficial uses. This informs DEQ in the identification of waters that are and are not meeting water quality standards. Waters not meeting water quality standards are impaired and DEQ places them on the state's 303(d) list of impaired waters. When performing assessments, DEQ uses data collected by DEQ and will use data collected by other entities if their data meets water quality objectives.

DEQ is more likely to support VM programs with this objective in project areas (i.e., watersheds or waterbodies) where DEQ is actively conducting a water quality assessment project. At times, DEQ receives requests for reassessment of waters where an individual or entity suspects an initial impairment listing was in error, or if there was insufficient information to perform the initial assessment. VM programs can work in conjunction with DEQ to collect specific parameters at specific locations to provide data that can be incorporated into these assessments. To be included in assessment decision-making, data collection efforts must adhere to DEQ monitoring protocols and assessment methods, and must meet data quality objectives. DEQ may support lab analysis funding support to VM groups pursuing this objective, although DEQ has more stringent requirements for quality assurance documentation, lab analysis funding and data management for this objective. DEQ is also likely to

provide monitoring design guidance and in-person training to VM programs pursuing this objective to help ensure that data meets the agency's assessment needs.

DEQ benefits from partnering with VM programs during assessment projects as this can lead to reduced need for DEQ monitoring resources, can build larger datasets toward higher confidence in assessment decisions, and can build public trust in DEQ methods and findings.

Objective 3 – Monitoring Trends

DEQ supports monitoring to analyze long-term trends in water quality condition on Montana's large rivers statewide. This objective involves collecting a standard suite of water quality parameters for many years from pre-selected, fixed monitoring stations on large rivers at pre-determined times of year.

DEQ may partner with a VM program to conduct monitoring related to long-term trend analysis on large rivers. VM programs pursuing this objective in partnership with DEQ are required to have technical staff and demonstrate longevity to ensure sampling efforts are sustainable over time. DEQ helps select fixed station monitoring locations, appropriate parameters, timing and frequency of sampling events, and helps provide or secure long-term funding for lab analyses and program administration through contracts with individual entities. DEQ managers must agree to a long-term funding commitment before any new trends monitoring programs or contracts are entered.

DEQ reports biennially on water quality trends on large rivers in Montana's Water Quality Integrated Report to help fulfill Clean Water Act Section 305(b) requirements. Fixed station monitoring can also help DEQ fulfill border agreement monitoring efforts, and may help reduce the need for DEQ monitoring resources.

Objective 4 – Support TMDL development and Source Assessment

A TMDL (Total Maximum Daily Load) is the maximum amount of a pollutant a river, stream or lake can receive and still support all designated uses. DEQ is required to develop a TMDL for each pollutant cause of impairment on the 303(d) list of impaired waters. During the TMDL development process, DEQ identifies sources of pollution and determines how much pollution waters can sustain and still fully support our needs. Then, they write plans that outline how to reduce pollution to those waters and assist local communities with finding solutions to restore and maintain clean water. VM programs can support the TMDL development process by collecting specific parameters at specific locations that can be incorporated into TMDL loading calculations or source allocations.

DEQ is more likely to support VM programs with this objective in TMDL planning areas where DEQ is actively developing TMDLs. To be included in TMDL development, data must adhere to DEQ monitoring protocols and must meet data quality objectives. Parameters must be relevant to evaluating pollution loads or pollution sources. DEQ may support lab analysis funding support to VM groups pursuing this objective, although DEQ has more stringent requirements for quality assurance documentation, lab analysis funding and data management for this objective. DEQ is also more likely to provide monitoring guidance and training to VM programs pursuing this objective to ensure data meets the agency's needs.

DEQ benefits from partnering with VM programs during TMDL development projects when VM efforts produce high quality, reliable data and reduces need for DEQ monitoring resources. VM program involvement with identifying and understanding sources of pollution in a watershed also helps to inform watershed planning efforts, builds local trust in DEQ's recommendations, and can promote water quality improvements.

Objective 5 – Developing and Implementing Watershed Restoration Plans

Science-based, locally-supported Watershed Restoration Plans (WRPs) are prepared to guide implementation of best management practices and education and outreach activities aimed at controlling nonpoint source pollution in a watershed. DEQ strongly encourages and supports efforts of local watershed groups and conservation districts to develop WRPs. Furthermore, groups seeking Clean Water Act Section 319 funds for water quality improvement projects (see Objective 6) must directly implement projects or activities identified in a DEQ-accepted WRP. The Environmental Protection Agency (EPA) requires nine minimum elements for WRPs, and both EPA and DEQ provide substantial guidance for developing these documents.

Monitoring and data analysis is a necessary component of developing several of the nine minimum elements of a WRP. VM programs can work in partnership with the local entity preparing and implementing a WRP to collect data used, for example, to identify sources of pollution, identify potential restoration project areas, estimate pollutant loading, determine load reductions, and to evaluate the effectiveness of implemented efforts over time.

DEQ benefits from this objective as WRPs informed by recent, site-specific VM data may be more thorough and accurate, and may have more community buy-in and ownership. Also, watersheds where community volunteers are actively engaged in pursuing water quality data, education and outreach may be more likely to produce cohesive and sustainable watershed planning efforts.

Objective 6 – Evaluating Effectiveness of Individual Water Quality Improvement Projects

Watershed restoration activities and best management practices are voluntarily implemented in Montana to improve and protect water quality. The primary goal of the NPS program is to restore water quality in waterbodies whose beneficial uses are impaired by nonpoint source pollution and whose water quality does not meet state standards. NPS program staff manage and distribute CWA Section 319 funding for water quality restoration projects. All projects that receive 319 funding must contain a task dedicated to monitoring project effectiveness, including quantifiable outcomes with respect to water quality, such as determining the annual nutrient or sediment load reductions achieved by the project. All water quality sampling and data analysis associated with 319 projects must be guided by a DEQ-approved Sampling and Analysis Plan (SAP) and/or a Quality Assurance Project Plan (QAPP).

Monitoring to evaluate project effectiveness may include collecting runoff water samples, photo monitoring, modeling, surveying, remote sensing, and other forms of evaluation. VM programs can be involved with developing SAPs, collecting data related to restoration mechanisms, and using this data to determine load reductions or compare to baseline data. DEQ may prioritize support for groups doing monitoring to collect site-specific data for specific parameters which are inputs for a specified model used to determine load reduction estimates, as described in DEQ's Load Reduction Estimation Guide. DEQ may also support VM programs who return to previous restoration projects (e.g., 5 years after project implementation) to evaluate long-term success of the project.

DEQ benefits from VM program involvement with this objective as these efforts often build local knowledge of restoration methods and BMPs that work well in a particular watershed or region of the state. It also allows DEQ's 319 program to more effectively rank project proposals by building confidence through project effectiveness monitoring that a project is more likely to result in WQ improvements.

Objective 7 – Evaluating Effectiveness of Cumulative Water Quality Improvement Activities

In Montana, DEQ's water quality assessment and TMDL processes are often strategically conducted on a watershed scale as opposed to addressing individual waterbodies scattered throughout the state. Likewise, watershed restoration plans (WRPs) (see Objective 5) developed by local entities typically address a wide range of water quality issues and multiple waterbodies throughout a watershed. This underscores the importance of evaluating water quality in the context of landscape-scale human activities and land uses that influence water quality conditions.

Over time, as water quality improvement and protection activities are completed and evaluated at the individual project scale (see Objective 6), larger scale improvements are realized at the larger waterbody or watershed scale. VM programs can collect data to determine if water quality in impaired watersheds is on an upward trajectory toward meeting water quality standards and supporting beneficial uses. This information can be used to refine WRPs by identifying waters in need of additional water quality improvement activities, and can help to trigger a TMDL Implementation Evaluation (TIE) by DEQ. TIEs are formal evaluations of progress in restoring water quality and implementation of reasonable land, soil and water conservation practices, often at a watershed scale. The process involves evaluating what water quality improvement activities have been implemented and what opportunities for additional improvements remain. The process also involves evaluating existing data, including VM program data, to determine whether water quality improvements are being realized.

When VM programs collect data relevant to evaluating progress toward water quality improvement and couple this information with a portfolio of water quality improvement projects, DEQ's TIEs can be more thorough. With sufficient data showing evidence of improvement resulting from cumulative water quality improvements, DEQ's Nonpoint Source Program may request that DEQ's Monitoring and Assessment Section reassess a waterbody to determine if it is meeting water quality standards and supporting beneficial uses (see Objective 8).

Objective 8 – Requests for Reassessment and Potential Success Stories

DEQ's Nonpoint Source Program supports water quality improvement and protection activities on impaired waterbodies. Over time, as progress is made through on-the-ground restoration and best management practices, water quality condition may improve to the point that water quality standards are met and beneficial uses are supported. When a person or entity suspects that water quality goals are being met, they may request that DEQ reassess water quality standards attainment and beneficial use support through DEQ's Nonpoint Source Program. Having data to substantiate suspected improvements, including water quality condition data and evidence of on-the-ground activities taken to address the impairment, is often required to trigger further investigation and reassessment by DEQ.

This objective involves the collection of water quality indicators relevant to the initial cause of impairment that put the waterbody on the 303(d) list of impaired waters. This may include the collection of primary or secondary parameters required via DEQ assessment methods or other useful supplemental information like time-lapse photos showing improvement over space and time. This objective may also involve monitoring over time to demonstrate periodically that milestones of water quality improvement are being met. DEQ may support VM programs pursuing this objective either before or after a request for reassessment is made. Monitoring design and other material support may be given to activities that are especially relevant to the impairment cause at hand. Material and technical support may also be given after a request is made if VM activities meet DEQ data quality objectives (see Objective 2).

When a waterbody is removed from the impaired waters list as a result of water quality improvement activities, DEQ reports these achievements as "success stories" to encourage similar actions across the state. Reporting success stories is a requirement of DEQ's, and DEQ benefits from being notified by VM

programs about potential success stories. DEQ may also benefit when VM programs collect high-quality data relevant to the reassessment, reducing the need for DEQ monitoring resources.

Objective 9 – Establishing Baseline Water Quality Conditions

Water quality conditions change over time, particularly as human activities and land uses in a watershed change. For example, changes may include expansion of residential development or transportation corridors, population growth, conversion of grassland to croplands or natural resource extraction. Baseline refers to conditions prior to development against which future conditions can be referenced. Baseline monitoring involves the measurement of environmental parameters, particularly those susceptible to the change anticipated. This information can then be used over time to compare pre-existing conditions to conditions post-change.

DEQ supports VM groups that pursue this objective, particularly where there are clear data gaps in areas where substantial change is anticipated. However, VM programs should take care to strategically select water quality indicators that are most directly linked to the anticipated change. For example, in an area where residential lawn expansion is expected, herbicides and nutrient fertilizers may be sensible parameters, whereas in a rural area where grassland is converted to cropland, sediment and pesticides may make sense. Or, where oil and gas development is anticipated, parameters such as methane or petroleum hydrocarbons and photo documentation of petroleum sheens may be most appropriate.

DEQ benefits from volunteer baseline monitoring efforts as these efforts can build local interest and awareness in water quality issues. If DEQ's data quality objectives are met, these efforts may help build datasets that DEQ can use for assessing waterbodies (Objective 1, 2), establishing natural background conditions or identifying sources (Objective 4). These efforts, especially when simplified for beginner VM programs, can also provide VM programs with experience in program management, SAP development, data management, monitoring methods, and volunteer recruitment and retention. This added capacity can improve VM programs' ability to achieve more complicated objectives.

Objective 10 – Education

While this VM Support Program will not directly fund purely educational monitoring initiatives, other programs do support this type of effort. Monitoring can be an effective tool to educate community members about water quality issues and watershed science. Youth programs through schools and adult education programs often incorporate monitoring. Generally, monitoring with education as the primary objective does not intend to collect data that meets specific data quality objectives, and is often used only to illustrate a concept rather than to inform assessments of water quality condition, watershed planning or restoration.

Funding for monitoring that will be used for educational purposes is available through the Education and Outreach Mini-grant program which is administered by Soil and Water Conservation Districts of Montana. Mini-grants are available on a biannual basis (spring and fall) and can be used for education and outreach efforts that address nonpoint source water quality issues.

DEQ benefits from this objective because it does not currently have a statewide education and outreach program. DEQ recognizes the value in using education to improve public perception and gain community understanding and buy-in for water quality restoration and protection activities at a local level.

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